Anti-soiling coatings for solar cover glass: Scope and Utilisation Challenges

ACTIVE BUILDING CENTRE RESEARCH PROGRAMME

Introduction

Soiling of solar cover glass reduces light transmission into the module. This reduces the electrical power output from a module to be reduced by typically 10% in northern temperate latitudes and by up to 50% in arid, dusty regions [1]'. These losses and the costs of maintenance are major issues for solar asset managers. They are also a concern for Building Integrated PV projects.

Problem Statement

With increased utilisation of PV at residential, commercial and utility scale, there is an urgent need to develop a low cost and durable anti-soiling coating. Ideally the coating should remain active throughout the lifetime of the PV installation. We have assessed the durability of currently available hydrophobic coatings and degradation is induced by UV exposure and by abrasion through regular cleaning cycles.

The exciting potential of hydrophobic coatings is shown here. The black panel was coated with a polymer hydrophobic and continued to produce power after snowfall. However, the coating failed after 8 weeks due to UV degradation and fluorine loss.

Proposed solution

Hydrophobic/low surface energy coatings. These provide:

- Low surface energy, reduced adhesion to dust and other surface contaminants
- Low roll-off angle for self cleaning
- Water contact angle >120°

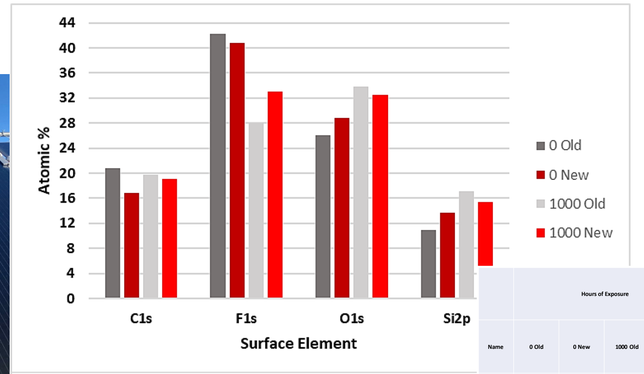
After the snow melt, residues remain on the uncoated panel on the left. The panel with the hydrophobic coating on the right is much cleaner. This is proof-of-principle that a hydrophobic anti-soiling coating will be effective. Improved durability is now required.

Progress made so far

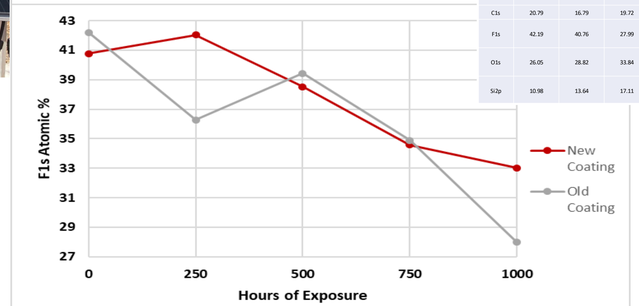
Current hydrophobic coatings assessed and degradation mechanisms identified. Work is now underway to improve durability

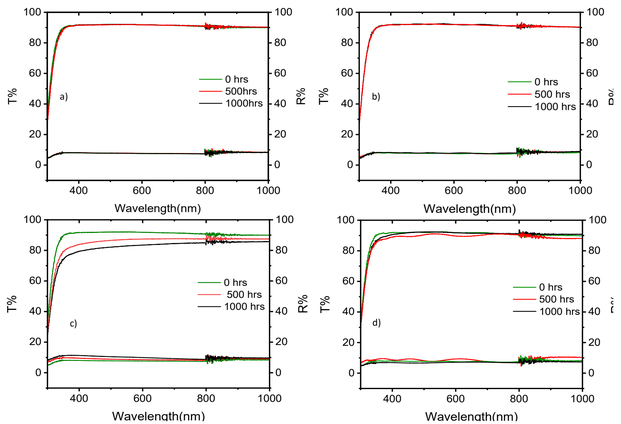
1. Testing the durability of anti-soiling coatings for solar cover glass by outdoor exposure in Denmark GC Oehler, F Lisco, F Bukhari, S Uličná, B Strauss, KL Barth, JM Walls Energies 13 (2), 299 (2020)
2. Development of a hydrophobic, anti-soiling coating for PV module cover glass, SF Bukhari, F Lisco, TB Moghim, A Taylor, JM Walls, 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC), 2849-2853
3. Degradation of hydrophobic, anti-soiling coatings for solar module cover glass,F Lisco, F Bukhari, S Uličná, K Isbilir, KL Barth, A Taylor, JM Walls,Energies 13 (15), 3811 (2021)

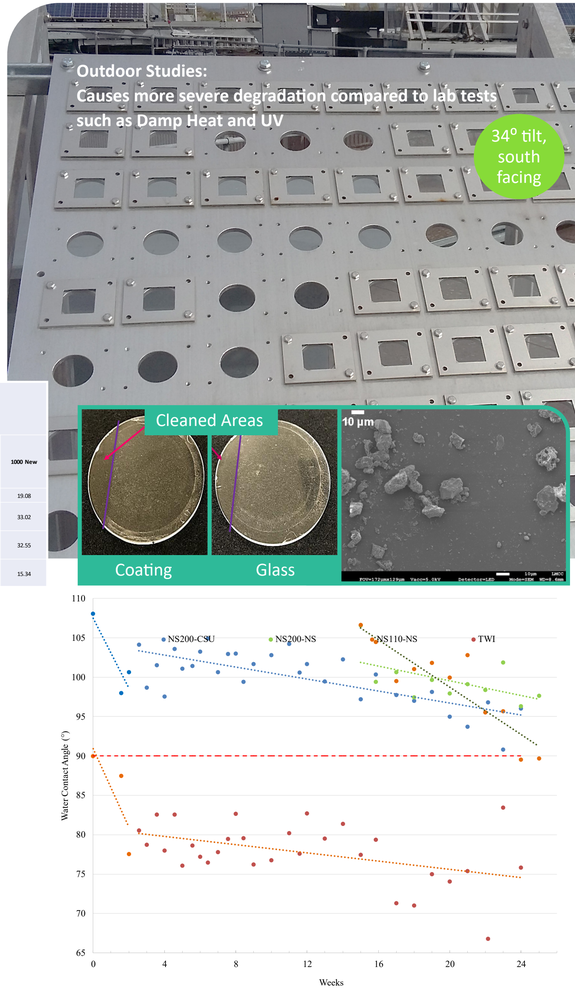
Optical Data, XPS and WCA from our work at Loughborough University shows formulations can be improved to suit the PV Industry needs.



Hours of Exposure				
Name	0 Old	0 New	1000 Old	1000 New
C1s	20.79	16.79	19.72	19.08
F1s	42.19	40.76	27.99	33.02
O1s	26.05	28.82	33.84	32.55
Si2p	10.98	13.64	17.11	15.34







Challenges

- Durability
- Reflection (Refractive Index)
- Prediction of performance at specific outdoor location
- Cementation

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